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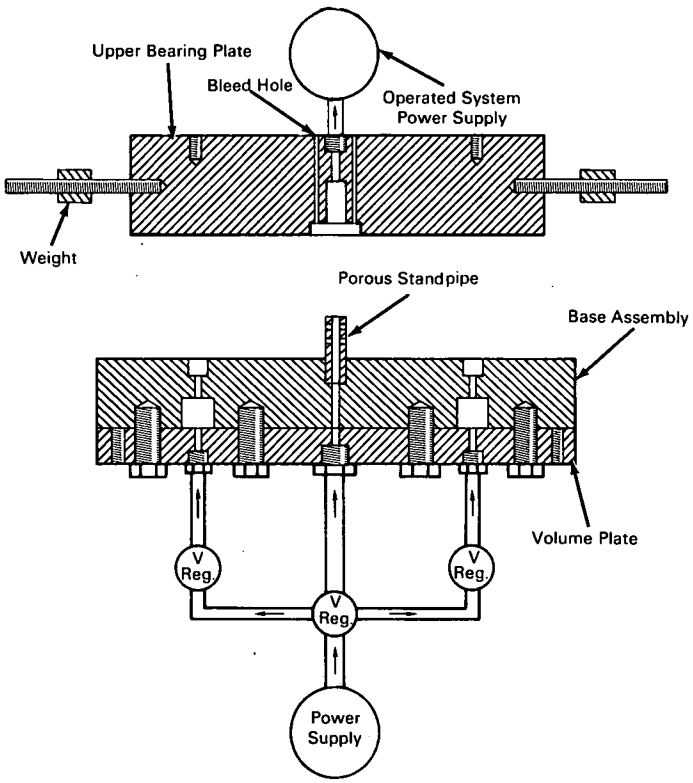
NASA TECH BRIEF

Fluid Power-Transmitting Gas Bearing



A fluid power-transmitting gas bearing has been designed that is essentially frictionless, stable, and highly efficient.

Previously, this problem was solved by floating one plate over another with a pressure force that originated at an orifice located at the center of the bottom plate. The transmission of fluid power through the bearing was achieved by the use of an inefficient "brute force" method. A fluid was simply forced from the center orifice, through the bearing gap, and into a recovery hole in the upper plate, thus providing fluid power for the operated system mounted on the upper bearing plate.

There are many disadvantages which are characteristic to this type of fluid power transmitting bearing. Since the pressure force originates at the center of the bearing, the pressure is high near the hub and atmospheric at the perimeter of the plate. This arrangement results in a highly unstable condition. In order to prevent large translatory motions of the upper bearing plate, centering jets are positioned to impinge radially upon the upper plate. These

(continued overleaf)

jets impart torques to the plate which, because of wall attachment, are virtually impossible to trim out. Another important disadvantage of this method is the fact that the fluid power supply cannot be regulated independently from the bearing power supply. Furthermore, there is a large pressure drop across the bearing gap which results in an inefficient transmission of fluid power through the bearing.

The two basic components of this design are the base assembly and the upper plate which are shown in the figure. The base assembly, which rests on a leveling base consists of a volume plate, a bearing surface plate, and a porous bearing standpipe. After entering the volume plate through supply ports, the bearing supply pressure is fed into a chamber from which it is evenly distributed to the orifices in the bearing surface plate. The operated system requiring the fluid power transmission is mounted on the upper plate. This system could be a fluidic control system, a momentum exchange or reaction jet device, for example. It might also be an electronic device which uses fluid power for an actuating signal. Once the fluid power is transmitted through the upper plate, its uses are virtually unlimited. This transmission is accomplished by the use of a porous bearing standpipe that provides a thin film of fluid between itself and the standpipe hole in the upper plate. After the control system is mounted on the upper plate, trimming the bearing is accomplished by adjusting the weights on the threaded shafts located on the sides of the upper plate.

There are many advantages of this invention over prior art. The pressure force used to float the upper plate originates nearer the perimeter of the bearing surface plate. The bleed holes provide a near atmospheric pressure at the center of the bearing. This condition of high pressure towards the perimeter and low pressure at the center results in a stable bearing. Consequently, the use of stabilizing jets is not necessary.

Fluid power can be delivered through the bearing efficiently because the bearing standpipe not only prevents translatory motions, but also serves as a resistance to the loss of system power. This power can be controlled independently from the bearing power without affecting the performance of the bearing.

The use of bleedholes to provide a central low pressure region is a feature believed to be new. Also the porous bearing standpipe, which is surrounded by a symmetric pressure distribution, is another idea believed to be new. Furthermore, the trimming procedure is an innovation to the art. Moreover, if the apparatus is combined with cylindrical bearings so as to make a two- or three-dimensional bearing; none of the problems characteristic of the "ball-cup" type bearings arise.

Note:

1. No additional documentation is available.
2. Technical questions concerning this invention may be directed to:

   Technology Utilization Officer
   Electronic Research Center
   575 Technology Square
   Cambridge, Massachusetts 02139
   Reference: B 68-10503

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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